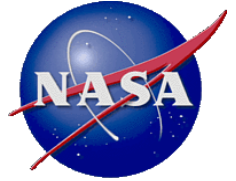
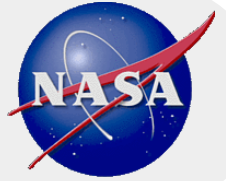


National Aeronautics and Space Administration



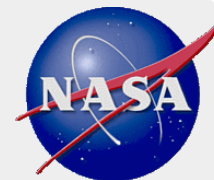
# Gabbard Plot Discussion

**Mark Matney**  
**NASA Orbital Debris Program Office**

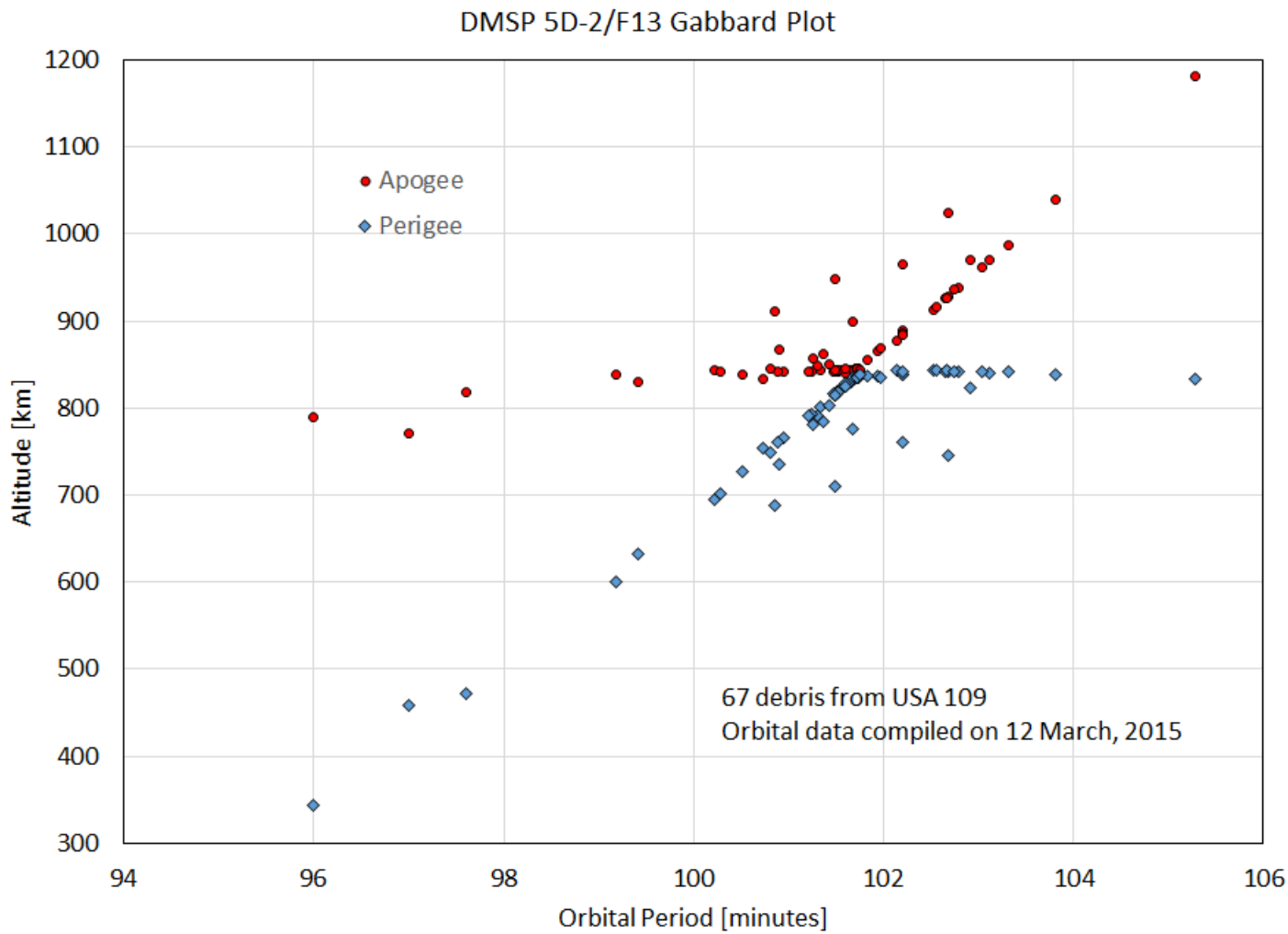


## Gabbard Diagrams

- **Developed by John Gabbard, a NORAD employee, in the 1960-70's to analyze and diagnose satellite breakups**
- **Plots orbital period of each debris object on x-axis and perigee/apogee on y-axis**
  - For these charts, apogee will be in red, perigee in blue
- **Forms a distinctive pattern, depending on orbit of parent body and location of breakup**



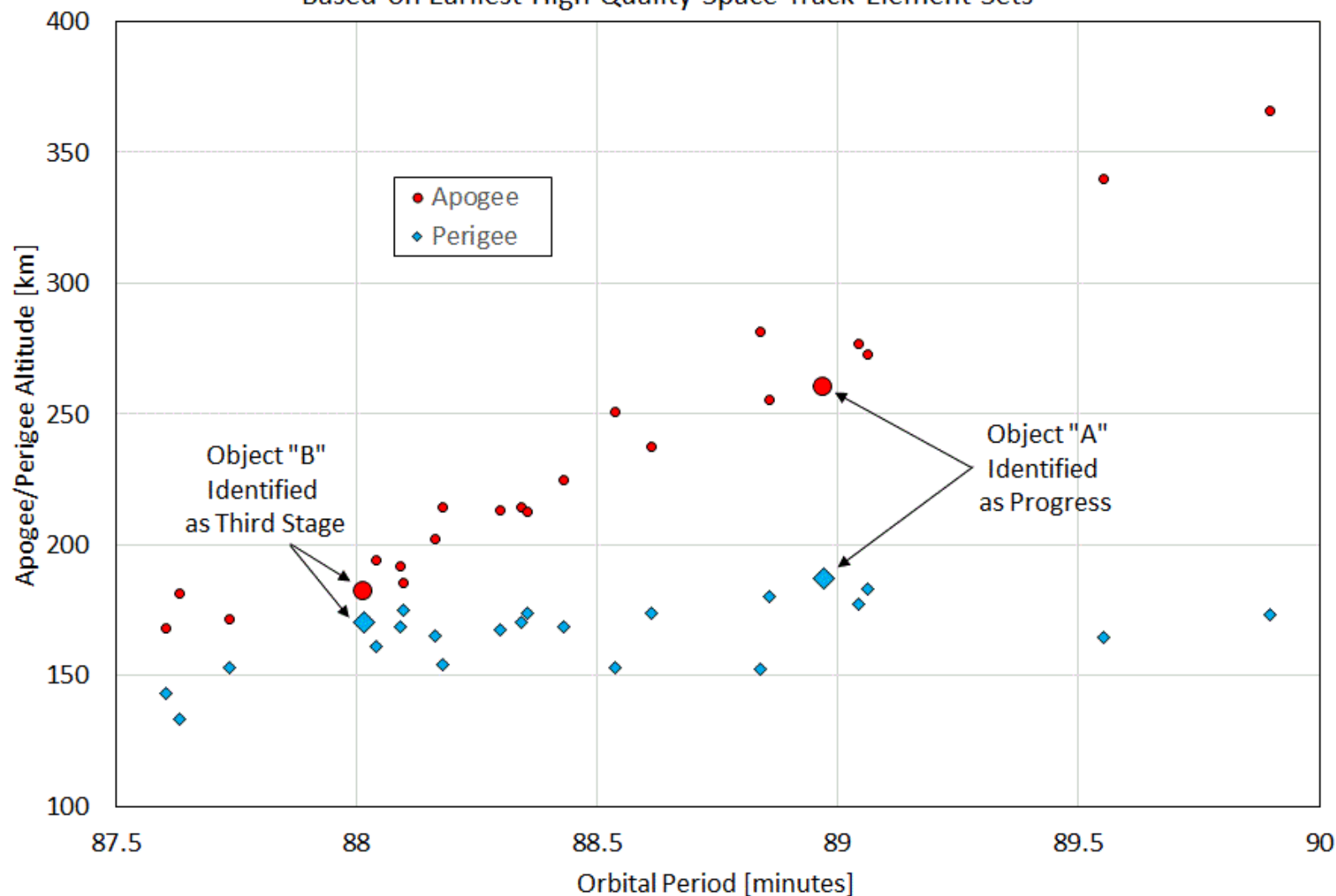
# Gabbard diagram of recent DMSP breakup





# Gabbard Diagram of recent Progress breakup

Gabbard Breakup Plot for Progress M-27M / Third Stage Anomaly  
Based on Earliest High-Quality Space-Track Element Sets





## Simple Model of Debris Cloud Generation

- **Used target orbit parameters 193 km x 238 km for parent breakup source (shown with black dots)**
- **Created isotropic debris at various breakup locations in parent orbit – perigee, apogee, and mid-point of orbit**

